BEFORE THE ENVIRONMENT COURT
AT AUCKLAND

I MUA I TE KŌTI TAIAO O AOTEAROA
KI TĀMAKI MAKAURAU

IN THE MATTER OF	the Resource Management Act 1991
And	appeals under clause 14 of Schedule 1 of the Act
BETWEEN	**TE TAIWHENUA O HERETAUNGA, TE RUNANGANUI O HERETAUNGA, TE MANAAKI TAIAO O HERETAUNGA AND NGATI KAHUNGUNU IWI INCORPORATED**
	ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INCORPORATED
	and
	THE MĀORI TRUSTEE
	Appellants
AND	**HAWKE'S BAY REGIONAL COUNCIL**
	Respondent

EVIDENCE IN CHIEF OF THOMAS JAMES KAY
ON BEHALF OF ROYAL FOREST AND BIRD PROTECTION SOCIETY

Geomorphology / Natural Character

1 September 2023

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INTRODUCTION

1. My full name is Thomas James Kay. I am the Conservation Advocate for Freshwater at the Royal Forest and Bird Protection Society of New Zealand Incorporated (Forest & Bird).

2. In 2013 I received a Short Award in Raft Guiding from Tai Poutini Polytechnic and completed a National Certificate in Outdoor Recreation (River Guide) as a Grade III Raft Guide through Skills Active NZ.

3. In 2016 I graduated from Massey University with a Bachelor of Science in Environmental Science. In 2021 I graduated from Massey University with a Master of Science (MSc) in Ecology. My MSc thesis focused on how to best measure changes in the physical characteristics of river habitat through time, particularly through the further development and application of the Habitat Quality Index / Natural Character Index (HQI/NCI)[1] as a measure of change in the physical form of a river in response to activities such as flood protection engineering.

4. I worked at Forest & Bird in various roles from 2017 - 2021 and again from 2022 - now.

5. During this time I have participated in numerous Resource Management Act processes, including providing evidence related to the protection of river habitat (as a component of ecosystem health) and natural character for the council-level hearing on Hawke's Bay Regional Council's (HBRC's) Proposed Plan Change 9 (TANK) in 2021[2]; assisting with mapping the character of the Ngaruroro River for an NCI assessment used in preparation of evidence for the Ngaruroro Water Conservation Order (WCO) Environment Court case in 2020[3]; and providing lay evidence on willow pole planting within the Ngaruroro River for the WCO Environment Court case in 2020.[4]

6. Through my work I have also taken an interest in understanding (and in some cases producing imagery of and/or assessing) changes in the extent and character of rivers throughout Aotearoa over time. I

[1] The HQI/NCI identifies and quantifies change in the physical habitat or natural character of a river over time. It involves assessing a river's 'current' form against its form at some point in the past (a 'reference' condition). See Fuller, I.C., Death, R.G., Garcia, J.H., Trenc, N., Pratt, R., Pitiot, C., Matos, B., Ollero, A., Neverman, A., Death, A. (2020). An index to assess the extent and success of river and floodplain restoration: recognising dynamic response trajectories and applying a process-based approach to managing river recovery. *River Research & Applications*, https://doi.org/10.1002/rra.3672

[2] Submission/Evidence # 210 (1), https://www.hbrc.govt.nz/assets/Document-Library/TANK/TANK-evidence/Expert-Evidence-Received-from-Submitters/Evidence-Compiled-Part5.pdf

[3] See Kay, T. J., Fuller, I. C., Anderson, P. (2022). Maintaining River Morphology Through Policy: a Case Study from the Ngaruroro Water Conservation Order. https://www.forestandbird.org.nz/sites/default/files/2023-03/Conference%20Poster%20-%20Maintaining%20River%20Morphology%20Through%20Policy%20A1.pdf

[4] Submission/Evidence # 210 (4), https://www.hbrc.govt.nz/assets/Document-Library/TANK/TANK-evidence/Expert-Evidence-Received-from-Submitters/Evidence-Compiled-Part5.pdf

have used this imagery and assessment to communicate the (often human-induced) changes in river morphology to communities across Aotearoa, and as a result have become more familiar with many rivers across the country. For example, in 2020 I undertook an HQI/NCI assessment of part of the Rangitata River for Forest & Bird[5] and more recently have been producing historical aerial mosaic imagery of many rivers around Aotearoa. While at Forest & Bird I have visited Canterbury three times, including a specific trip involving visits to sites (and filming video with a drone) along the Rangitata River from the confluence of the Havelock and Clyde Rivers all the way to the sea. On the most recent visit in August 2023, I flew a drone to take photos of the Orari, Rangitata, and Rakaia Rivers, as well as undertaking a site visit to the Ashburton River / Hakatere.

7. From 2021 - 2022 I worked at Kāhu Environmental as a Policy Advisor. During this time one of my projects involved using the HQI/NCI method to undertake a baseline assessment of river habitat in the Mangatainoka River prior to prosed gravel extraction activity.

8. In September 2022 I attended the Massey University Innovative River Solutions 'Rivers Practitioners Workshop'.

9. I am an experienced whitewater kayaker and have kayaked and rafted for recreation, competition, and work on rivers in almost every region of Aotearoa. This includes the Rangitata River in Canterbury, as well as Hawke's Bay rivers including the Mohaka River between Poronui Station and Willow Flat, the 'Oxbow' (Kuripapango) and 'Lower Gorge' (Kuripapango to Whanawhana) sections of the Ngaruroro River, and the Waikaretaheke River.

10. I was born and grew up in Napier, in Hawke's Bay.

11. As a result of the work and recreation outlined above, as well as through growing up in Hawke's Bay, I have become familiar with the rivers of Hawke's Bay and Canterbury in particular.

12. I am a member of the New Zealand Freshwater Sciences Society, the Engineering New Zealand Rivers Group (of which I am a committee member), and Whitewater NZ.

13. I have been asked to provide expert evidence for Forest & Bird on the braided character of the Ngaruroro River in the context of Hawke's Bay rivers. I understand the obligations on me as an expert

[5] Kay, T. (2020). Habitat Quality Index Assessment, Rangitata River, Arundel to Ealing. https://www.forestandbird.org.nz/sites/default/files/2021-04/Rangitata%20River%20HQI%20Report%20%28May%202020%29.pdf

witness and that this is separate to my role as an advocate with Forest & Bird. This evidence is based on and limited to my knowledge as an expert in the natural character and form of rivers.

14. I confirm I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023 and that I agree to comply with it. Other than when I state that I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

SCOPE OF EVIDENCE

15. I have been asked by Forest & Bird to provide evidence for these proceedings relating to the braided character of the Ngaruroro River in the context of Hawke's Bay rivers and the Outstanding Water Bodies plan change / Plan Change 7 (PC7). My evidence describes river geomorphology and natural character; assesses whether the Schedule 25 Screening Criteria (which include the values of 'Natural Character' and 'Geology') adequately provide for braided rivers; and considers whether any Hawke's Bay rivers should be considered regionally outstanding for their braided character. In my opinion, the water body that stands out in the Hawke's Bay region for its braided character is the reach of the lower Ngaruroro River between the Whanawhana Cableway[6] and the Fernhill Bridge / Omahu[7], particularly the reach between the Whanawhana Cableway and the top of the HBRC Flood Management Scheme.[8]

16. In preparing this evidence I have reviewed the evidence of the following experts:

    a. Evidence in Chief (Geology) of Jens Rekker dated 11 August 2023,
    b. Evidence in Chief of Dr Greg Ryder dated 11 August 2023,
    c. Evidence in Chief (Planning) of Belinda Harper dated 11 August 2023,
    d. Evidence in Chief (Ecology) of Dr Andy Hicks dated 11 August 2023, and
    e. Evidence in Chief (Ecology) of John Cheyne, dated 1 September 2023.

17. I have also relied on the following key documents from the Plan Change 7 process:

    a. HBRC's preferred version of Proposed Plan Change 7 – Outstanding Water Bodies (30 June 2023, updated and recirculated 13 July 2023),

[6] Map reference NZTM2000: 1891901E, 5615830N.
[7] Map reference NZTM2000: 1923019E, 5611264N.
[8] Map reference NZTM2000: 1906679E, 5610950N.

b. Decision of the Independent Hearing Panel. Proposed Plan Change 7. Regional Resource Management Plan – Outstanding Water Bodies. June 2021.
c. Outstanding Water Bodies in Hawke's Bay. Report of the Expert Panel. April 2019. HBRC Report No. SP19-19.
d. Water Conservation Order Review. Outstanding Values: Key Features. For: Community Environment Fund - Outstanding Freshwater Body Project. Report Humber: SD 19-23. Publication Number: 5409. Prepared by Belinda Harper. September 2020.
e. Criteria and Methodology for Determining Outstanding Freshwater Bodies. Literature Review One, Part Two: Summary Report. December 2015. Prepared by Belinda Riley.

18. Additional documents I have relied on and referenced are noted throughout my evidence.

GEOMORPHOLOGY AND NATURAL CHARACTER

19. Rivers consist of various combinations of physical features, such as riffles, runs, pools, backwaters, and bars. These features – or 'morphological components' – in combination with the characteristics of the channel (straight, sinuous, etc.) and floodplain (wide, confined by terraces, gorged, etc.), as well as flow/discharge regimes and sediment supply, determine a river's unique form. These characteristics vary by catchment, and are restricted by variables such as rainfall and runoff, geology, land cover (e.g. vegetation), gradient, erosion rates, and valley-floor confinement.

20. Rivers and streams are, overall (and generally), stable in form and make frequent adjustments within that form in response to subtle changes in catchment conditions, such as flow or sediment supply, which differ with every drought, storm, or flood. Sometimes larger changes in a catchment (such as changes in climate or extreme weather events) result in the form of a river changing more substantially. The study of these river-forming processes is known as fluvial geomorphology.

21. The overall form of a river, in combination with the 'mosaic' of features (the riffles, runs, pools, etc.) within the river, defines its 'natural character' in the context of geomorphology.

22. Figure 1 illustrates a 'continuum' of river forms, each with its own natural character and geomorphological features.

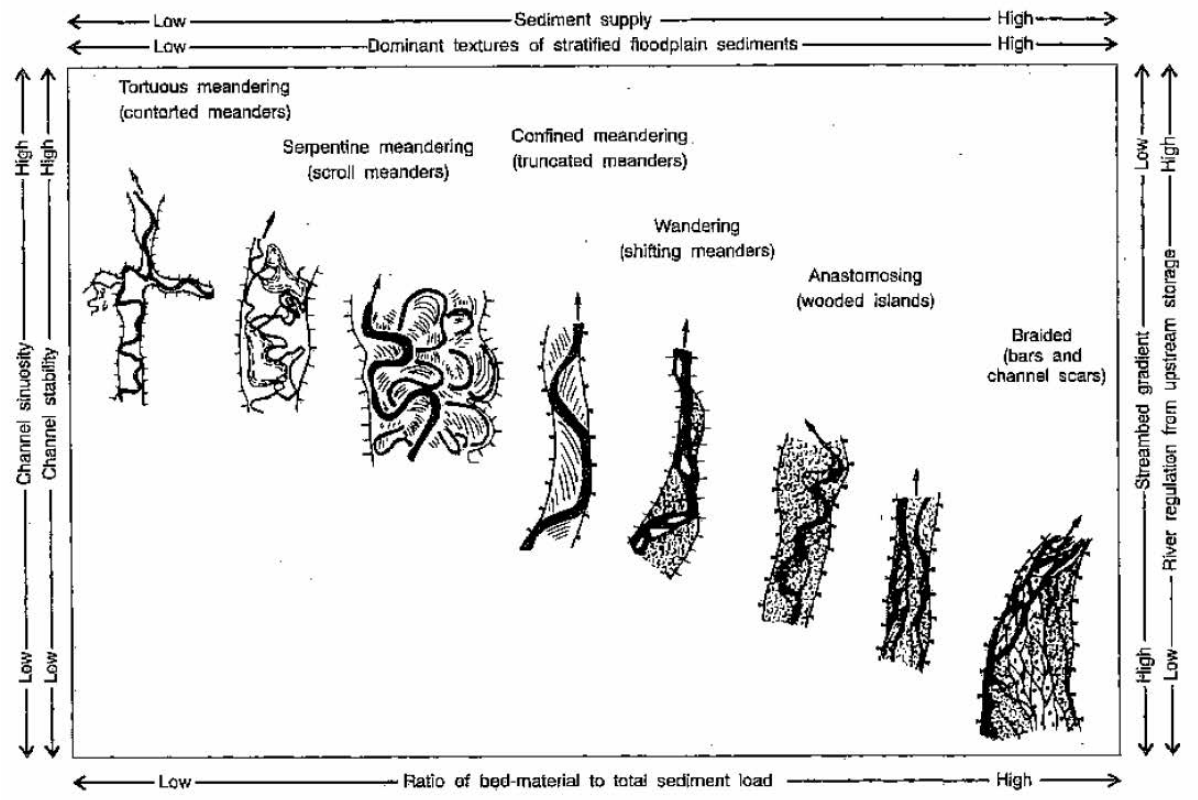


Figure 1: The continuum of alluvial river channel types, from meandering to braided (Fig 16.1, from Mosley, 1992, cited in Fuller[9]).

23. In many places, human activity – such as changes in land cover and flood protection works – has significantly altered sediment and flow regimes. As a result, many catchments and the rivers that flow through them are no longer in an entirely natural or pristine state. However, these rivers in adjust their geomorphology to this modified state and develop a form reflecting the prevailing sediment and flow regimes, and catchment conditions—i.e. the river adopts a modified, but stable, 'natural character'. This results in not only a continuum of river types (from meandering to braided, as per Figure 1) but also a continuum of natural character.

RECOGNISING BRAIDED RIVER CHARARACTERISTICS AS OUTSTANDING

24. In my opinion, a possible outstanding value for a river is braided river character. This opinion is based on the (at least) two national Water Conservation Orders (WCO) which identify braided river

[9] Ngaruroro Water Conservation Order case. Expert Rebuttal Evidence of Ian Fuller on behalf of Royal Forest & Bird Protection Society, dated 27 November 2020.

characteristics as outstanding characteristics and features.[10] These cases indicate that braided river character is a value for which a river should be able to be considered outstanding.

25. Table 1 of the Council's preferred version of PC7 includes several braided and semi-braided/wandering rivers as being outstanding (the Tukituki, Tūtaekurī, and Ngaruroro). However, none are considered outstanding for their braided character. For example, the lower Ngaruroro River is braided but this braided character is considered outstanding only for its value as native aquatic bird habitat, not for the braided character itself. This is the same for the Tukituki River. The Tūtaekurī River is included only for cultural and spiritual values.

26. The Council's preferred PC7 provisions include screening criteria which identify a number of values for which a water body could be considered outstanding. This includes the values of Geology and Natural Character. These are the criteria that best provide the potential for outstanding geomorphological characteristics (e.g., river braiding) to be recognised. I have not considered the 'Landscape – Wild and scenic' criteria in my evidence as I do not consider it to be as relevant (given I understand this has generally been used in WCOs to recognise 'wilderness' values), and it is not my area of expertise.[11]

27. I have assessed these (Natural Character and Geology) screening criteria and consider that the way in which the criteria have been drafted effectively excludes braided river character being recognised as an outstanding value in Hawke's Bay. As I discuss immediately below and in more detail later in my evidence, this is because there are elements included in both the Natural Character and Geology criteria that braided rivers in Hawke's Bay (and in other regions) cannot meet.

28. With regard to the Natural Character value, a water body must be "within a largely indigenous landscape" (List A (a)) to qualify as outstanding. The braided reaches of Hawke's Bay rivers are not located within largely indigenous landscapes – they traverse foothills and plains that have been modified (notably, cleared of indigenous vegetation). This effectively excludes these water bodies from being included for Natural Character. Water bodies must also have "little or no human modification" to their "riparian margins". This is a similarly difficult criteria to meet for a braided river, with many

[10] The National Water Conservation (Rakaia River) Order 1988 includes "an outstanding natural characteristic in the form of a braided river…"; and the Water Conservation (Rangitata River) Order 2006 includes "Scientific – braided river" as one of the "Outstanding Characteristics or Features". Note the Rangitata WCO specifically lists this value throughout the river, including from the Rangitata Gorge to the coast.

[11] However, it is worth noting (and is discussed later in my evidence) that the Expert Panel, in their report, listed the braided character of the Lower Ngaruroro River, the Ngaruroro gorge, and the Taruarau gorge as 'Landscape' values based on their listing in the NZ Geopreservation Inventory. (Outstanding Water Bodies in Hawke's Bay. Report of the Expert Panel. April 2019. HBRC Report No. SP19-19.) https://www.hbrc.govt.nz/assets/Document-Library/Outstanding-Water-Bodies/1.-Other-supporting-information/Local-Expert-Panel-Report.pdf

braided river channels either confined by old river terraces (which have been 'developed' on their tops) or adjacent to agricultural land uses (which utilise the plains for production – e.g., Hawke's Bay and Canterbury).

29. It is worth noting that the Rangitata and Rakaia River WCOs both apply to rivers that traverse a highly modified landscape (the Canterbury Plains) with varying degrees of modification to the "flow, bed and riparian margins, water quality, [and] flora and fauna" but were still afforded outstanding status for their braided characteristics.

30. With regard to the Geology value, the criteria require that the "geomorphological, geological or hydrological feature" must be "classified as Class A on the New Zealand Geopreservation Inventory". There are no braided rivers in Hawkes Bay classified as Class A on the New Zealand Geopreservation Inventory. Therefore, no Hawke's Bay rivers can qualify as outstanding for their braided character. Further, there appears to be very few braided rivers across Aotearoa classified as Class A on the Inventory – the Rakaia River being the notable example. Braided character in the Waitaki and Wairau Rivers is allocated Class C,[12] as it is in the Ngaruroro (discussed more below). The Rangitata River, despite having a WCO recognising its braided river value, does not feature in the Inventory.[13]

31. The effect of these criteria is that braided rivers in Hawke's Bay could not be considered outstanding by virtue of their braided character. In my opinion, this is a flaw with the screening criteria. I consider an amendment is needed to the criteria to ensure braided river character can be recognised as an outstanding value in Hawke's Bay. This would be best achieved by

    a. providing an exclusion in the Natural Character criteria for braided rivers to be located within largely indigenous landscapes and have a degree of modification to their riparian margins, and

    b. deleting the reference in the Geology criteria requiring a water body to be classified on Class A of the New Zealand Geopreservation Inventory.

NATURAL CHARACTER CRITERIA: ASSESSMENT OF THE LOWER NGARURORO RIVER

32. In the following paragraphs, I undertake an assessment of the lower Ngaruroro River against the Council's preferred PC7 Natural Character Screening Criteria. As noted above, I conclude that this

[12] The Wairau is described as "Excellent representative example of braided river beds in Marlborough Rivers." https://naturemaps.nz/maps/#/viewer/openlayers/484
[13] Ibid.

section of the river does not meet the criteria. However, for reasons I discuss in more detail below and in subsequent sections, I consider the reach of the lower Ngaruroro River between the Whanawhana Cableway[14] and the Fernhill Bridge / Omahu[15], particularly the reach between the Whanawhana Cableway and the top of the HBRC Flood Management Scheme,[16] does stand out in Hawke's Bay for its braided river character.

33. HBRC's preferred version of Proposed Plan Change 7 includes three criteria for Natural Character that a water body must meet all of to qualify as outstanding for that value. These are:

    a. The water body is highly natural with little or no human modification, including to the flow, bed and riparian margins, water quality, flora and fauna, within a largely indigenous landscape.
    b. The natural character values are conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region.
    c. Evidence is provided in support of outstanding natural character values by way of an expert assessment or independent evidence sources.

34. Jens Rekker, in paragraphs 9.69 - 9.71 of his evidence assesses the lower Ngaruroro River against these criteria. His conclusions against criteria (a) are addressed in two parts across paragraphs 9.69 ("(a)…highly natural with little or no modification…") and 9.71 ("(a)…within a largely indigenous landscape…"), while the assessment against criterion (b) is addressed is paragraph 9.70 ("(b)…conspicuous, eminent and/or remarkable…"):

    9.69 The lower Ngaruroro River has been modified by flood protection works, partial or complete diversions, gravel extraction for the aggregate resource and floodplain encroachment by flood embankments and other structures. The modification has resulted in the lower Ngaruroro River becoming increasingly confined to a permanent floodway for all but extreme flooding events, which has adversely affected its hydrological function in recharging the Heretaunga Aquifer and the river's ability to rework its braided gravel bed. Therefore I am of the opinion that the lower Ngaruroro River does not meet the threshold of being a water body that is highly natural with little or no human modification.

    9.70 The natural character values of the lower Ngaruroro River are significantly affected by flood control, infrastructural crossings, invasive exotic plant species and gravel extraction. As a result, the active braid plain is currently narrower and more constrained relative to its natural state and has a narrower zone of river dynamics such as braiding or groundwater interactions. Therefore, I am of the opinion that the lower Ngaruroro River does not meet the threshold of conspicuous, eminent and/or remarkable natural character values in the Hawke's Bay context.

    9.71 The Ngaruroro River downstream of Whanawhana Cableway is a good example of a braided gravel river, but due to its passage through modified landscapes with urbanisation and intensification

[14] Map reference NZTM2000: 1891901E, 5615830N.
[15] Map reference NZTM2000: 1923019E, 5611264N.
[16] Map reference NZTM2000: 1906679E, 5610950N.

of landcover for primary production, does not meet the criteria for natural character in terms of the OWB identification criteria for the natural character value set.

35. Regarding Natural Character criterion (a), while part of the lower Ngaruroro River has been modified by flood protection works and other activities, Mr Rekker's assessment oversimplifies the character of the river and the impact of (or lack of impact of) human activity downstream of the Whanawhana Cableway.

36. This oversimplification is a repeat of that of the Independent Hearing Panel, who stated at paragraph 6.92 of their decision "The lower Ngaruroro River downstream of Whanawhana is a highly modified braided river that flows between stop banks designed to prevent flooding of Hastings and other local townships, and extensive tracts of farmland."

37. In his evidence for the Ngaruroro WCO case,[17] Professor Ian Fuller identified six discrete reaches of the river downstream of the Omahaki Stream confluence based on the degree of channel confinement:

    i. Omahaki Stream confluence to Whanawhana: significantly confined, narrow valley floor (gorge) [approx. 6 km long]
    ii. Whanawhana to Matapiro Rd: limited confinement, wide valley floor occupied mostly by braidplain [approx. 8 km long]
    iii. Matapiro Rd to top of HBRC Flood Management Scheme: narrowed active channel confined by river terraces, occupied mostly by wandering-semi braided river [approx. 10 km long].
    iv. Top of HBRC Flood Management Scheme to Fernhill Bridge: active channel confined by stopbanks, occupied mostly by wandering-semi braided river [approx. 21 km long]
    v. Fernhill Bridge to Chesterhope Bridge: active channel confined by stopbanks, occupied mostly by single thread wandering river [approx. 11 km long]
    vi. Chesterhope Bridge to river mouth: artificial cut mainly comprising single tidal channel, although some bar formation evident towards upstream end [approx. 6 km long]

38. This is a similar assessment to that provided by Rachel McClellan in her evidence for the Special Tribunal hearing on the Ngaruroro WCO application, which stated (noting Ms. McClellan groups all braided and semi-braided/wandering reaches (ii – iv) together):[18]

    The Ngaruroro River is one of the North Island's largest braided rivers.[1] The river can be divided into four main sections:

    a) The upper reaches of the river above the Whanawhana cableway (and its tributaries) which are mostly single channel…

[17] Ngaruroro Water Conservation Order case. Expert Evidence in Chief of Ian Fuller on behalf of Royal Forest & Bird Protection Society, dated 3 September 2020.
[18] Ngaruroro Water Conservation Order. Statement of Evidence of Rachel Katherine McClellan, dated 19 October 2017.

b) The reaches between Whanawhana and the Fernhill Bridge which are extensively braided…
c) The reaches below Fernhill, which are more modified and mostly single channel…
d) The Waitangi Estuary and associated wetlands, including the gravel bars, and the Railway Wetland….

[1]Wilson G. 2001: National distribution of braided rivers and the extent of vegetation colonisation. Landcare Research Contract Report LC0001/068. Prepared for the Department of Conservation, Twizel.

39. Professor Fuller's assessment illustrates the variation in the degree of naturalness in (and modification to) different reaches of the lower river, with largely natural confinement in reaches (i) - (iii) where the river is gorged and then confined by natural terraces, and increasingly human-induced confinement in reaches (iv) - (vi) where the river is ultimately constrained by stopbanks closer to the coast (Figure 2).

Figure 2: Aerial image[19] of the Ngaruroro River with HBRC stopbanks overlaid (red lines). A significant portion of the river (the majority from the centre of the image upstream to the left of the image) is not confined by stobanks. Napier and Hastings at the right of the image.

40. The Ngaruroro River Flood Protection and Drainage Scheme Ecological Management and Enhancement Plan[20] clearly shows the separation between the more actively managed flood protection 'Scheme Area' and the wider 'Management Area' (Figure 3). A significant portion of the Ngaruroro River's braided area falls upstream of the HBRC Flood Management 'Scheme Area' (i.e., is in an area of limited river 'management' or intervention).

[19] Sourced from the LINZ Data Service and licensed for reuse under the CC BY 4.0
[20] https://www.hbrc.govt.nz/assets/Document-Library/Publications-Database/4276-AM11-04-Ngaruroro-Ecological-Management-Plan.pdf

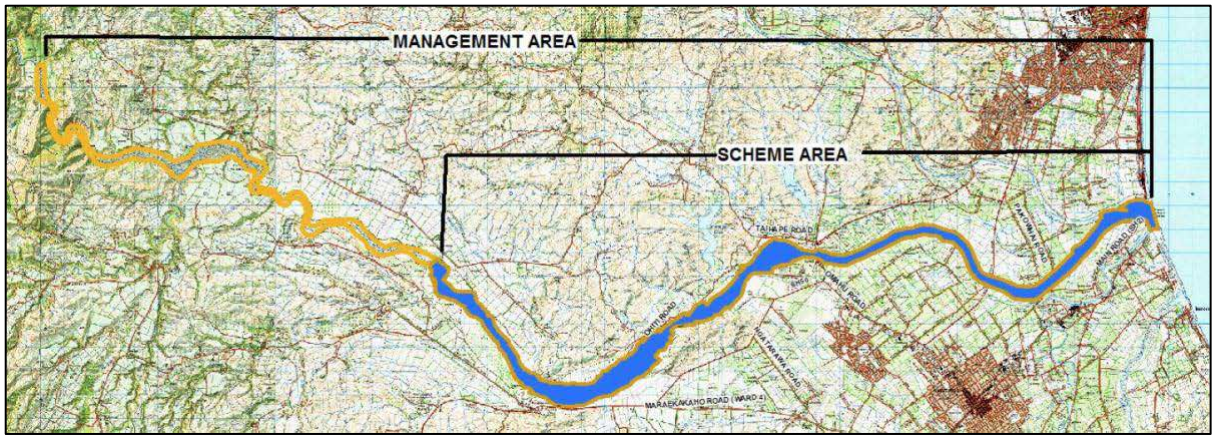


Figure 3: Extent of the Ngaruroro 'Scheme area' in relation to the wider 'management area' and surrounding environment.

41. This variation in confinement (and the degree of impact from the HBRC Flood Management Scheme and stopbanks) can also been seen in variation in the active channel width[21] of the Ngaruroro River from Whanawhana down to the coast, as illustrated in Figure 4. This graph shows there is substantial variation in the active channel width of the river upstream of the HBRC Flood Management Scheme area (from around 100m wide to over 700m wide), which is characteristic of the river operating within the space naturally available to it (rather than being actively confined by human intervention). After exiting the gorge and flowing through an extremely wide braided section (Reaches (ii) – (iii) as identified by Prof. Fuller), the river narrows and becomes more consistent in width when it enters the HBRC Flood Management Scheme Area (Reach (iv)) and narrows further where it is lined on both sides with stopbanks (Reach (v)). Compare Figures 2-4.

[21] The active channel width is the width of the wetted channel, active gravel bars, and mid-channel islands combined (including those with vegetation where it isn't mature enough to limit reworking).

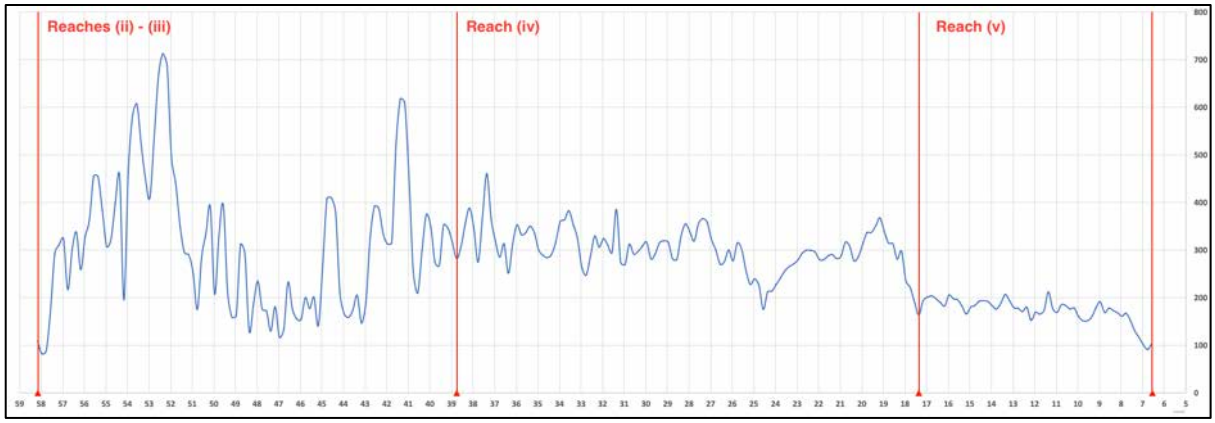


Figure 4: Graph showing the variation in the active channel width of the Ngaruroro River from the Whanawhana Cableway (left of the graph) downstream to within 6km the coast (right of the graph). The y-axis shows the channel width in metres (higher = wider) and the x-axis shows distance from the sea in metres (flowing from the left (upstream) to the right (downstream)). Substantial variation can be seen in the active channel width of the river upstream of the HBRC Flood Management Scheme area (Reaches (ii)-(iii)). The river narrows and becomes more consistent in width when it enters the HBRC Flood Management Scheme Area (Reach (iv)) and narrows again where it is lined on both sides with stopbanks (Reach (v)). Measurements taken in QGIS at 200m intervals using 2019/2020 aerial imagery. Smoothed line connects points. Larger graph provided as an appendix.

42. Figures 2-4 illustrate the lower Ngaruroro River (below the Whanawhana Cableway) is not simply one homogenous reach – it is better considered as a number of reaches with varying degrees of modification, which traverse a continuum of highly natural to highly modified. Some of these reaches are naturally confined (e.g., by terraces) while others have been constrained by human intervention such as edge protection planting and stopbanks. In particular, the reach from the Whanawhana Cableway to the top of the HBRC Flood Management Scheme is largely unimpacted by human confinement and reflects a natural braided and semi-braided/wandering form (discussed further below). While the reach from the top of the HBRC Flood Management Scheme to Fernhill Bridge/Omahu has been confined by human activity and is not as natural as the section upstream, it generally still has a wider active channel than other Hawke's Bay rivers and exhibits a relatively high degree of braiding too (see Braiding Index in Table 1 and comparison to other rivers later in this evidence).

43. The active channel width, extent of braiding, and area of unvegetated gravel from Whanawhana to the Fernhill Bridge/Omahu (across reaches (ii) – (iv) as defined by Prof. Fuller) was included in the evidence of Professor Ian Fuller for the Ngauroro WCO Environment Court case. A summary from his evidence is provided in Table 1 below. This shows how relatively high braiding still occurs across these reaches

(i.e., braiding within the reaches covered by the HBRC Flood Management Scheme can still be comparable to braiding within the reaches upstream of the Scheme).

Reach	Whanawhana to Matapiro Rd			Matapiro Rd to top of HBRC flood management scheme			Top of HBRC flood management scheme to Fernhill Bridge		
Year	2010/2011	2014/2015	2019/2020	2010/2011	2014/2015	2019/2020	2010/2011	2014/2015	2019/2020
Active channel width (m)	379	390	364	279	274	269	304	301	301
Braiding index (Brice's)	5.48	3.19	2.49	2.65	1.66	1.91	4.13	2.16	2.46
Unvegetated bars (area, ha)	211.07	196.07	218.89	207.19	228.08	220.55	462.82	528.51	503.03

Table 1: Active channel width, extent of braiding,[22] and area of unvegetated gravel from Whanawhana to the Fernhill Bridge/Omahu (across reaches (ii) – (iv) as defined by Professor Fuller) based on 2010/2011, 2014/2015, and 2019/2020 aerial imagery. High braiding index in 2010/2011 appears to be related to higher flows (discussed in Prof. Fuller's evidence).

44. The high degree of naturalness in the form of the braided reaches of the Ngaruroro River between Whanawhana and the top of the Flood Management Scheme in particular can be confirmed by looking at historical imagery of the riverbed and by comparing measurements of characteristics like active channel width over time. This is effectively a comparison of the current condition of the river to a more natural 'reference' condition.[23] Figure 5 does this by showing the active channel width of the riverbed in 1950 (black line) and 2019/2020 (blue line). The close tracking of the lines shows the riverbed through this reach has maintained a similar form across the last c. 70 years.

45. Figures 6 and 7 in the following pages show the river in parts of this reach in 1950 and in 2019/2020 for visual comparison.

46. Based on the above analysis, I consider the dismissal of the lower Ngaruroro River as being "highly modified" by the Independent Hearing Panel and the assessment of Mr Rekker that the lower river does not meet the threshold of being a "water body that is highly natural with little or no human modification" to be incorrect. In my opinion, these conclusions are simplifications of the geomorphological condition of the lower river throughout its entire length.

[22] Braiding was assessed using Brice's Index, as defined in the work of Death et al. (in prep.), which states the extent of braiding is twice the total length of mid-channel bars in a reach divided by the mid-channel length of that reach.

[23] This is the technique used in the Habitat Quality Index / Natural Character Index assessments. Historic imagery is available for many rivers across Aotearoa at a point in time when they were largely unmodified (notwithstanding vegetation clearance in upstream catchments, etc.), so this makes a good reference condition for the present.

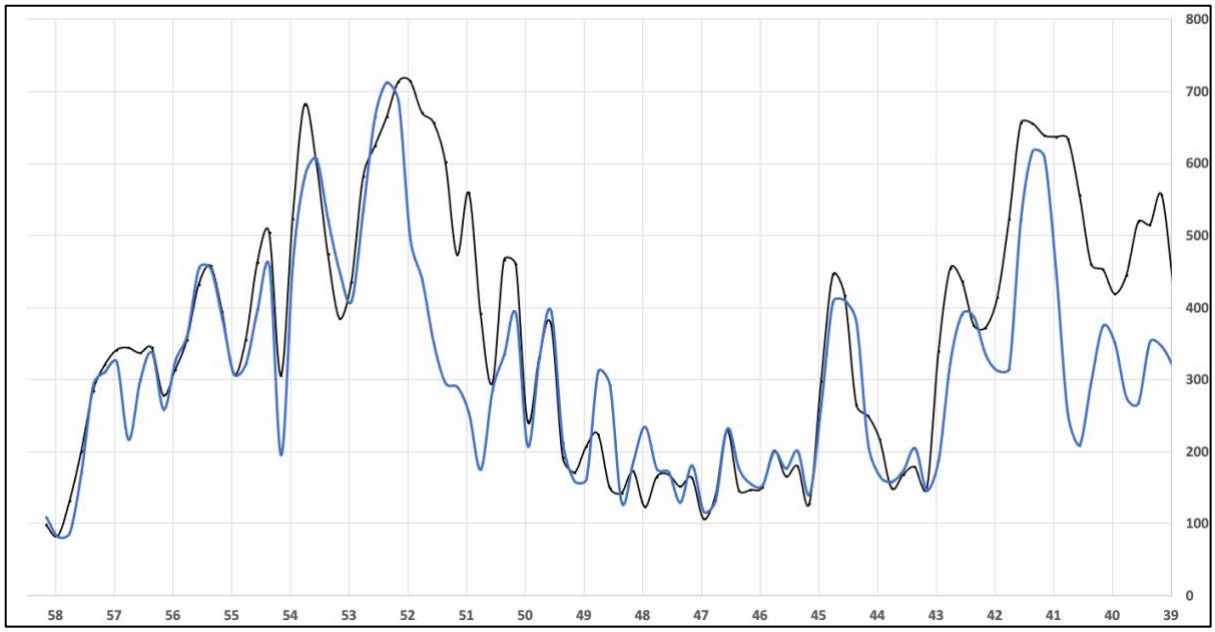


Figure 5: Graph comparing the active channel width of the Ngaruroro River in 1950 (black line) and 2019/2020 (blue line) from the Whanawhana Cableway (left of graph) downstream to the top of the HBRC Flood Management Scheme area (right of graph). The y-axis shows the channel width in metres (higher = wider) and the x-axis shows distance from the sea in kilometres (flowing from the left (upstream) to the right (downstream)). The width of the active channel in 2019/2020 remains similar to that in 1950. The graph stops at the top of the HBRC Scheme as measurements for 1950 were not taken downstream of this point (and it is obvious from this point that the Scheme has caused significant channel confinement). Measurements taken in QGIS at 200m intervals using 1950 and 2019/2020 aerial imagery. Smoothed line connects points. Where gaps existed in 1950 imagery, 2023 post-Cyclone Gabrielle imagery was used to measure active channel width as it appears consistent with 1950 widths.

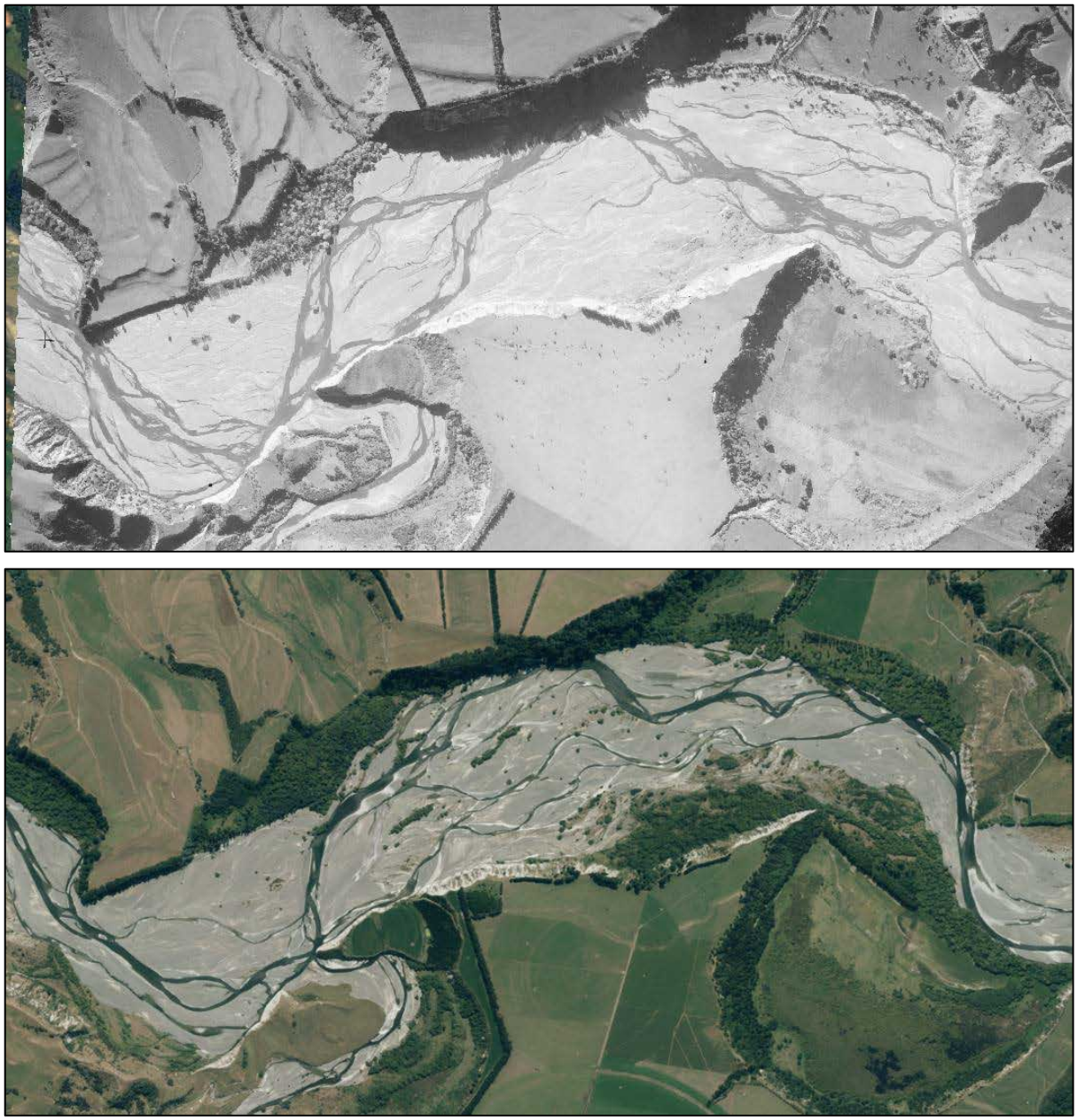


Figure 6: Aerial imagery[24] of the Ngaruroro River about 1km downstream from the Whanawhana Cableway in 1950 (top) and 2019/2020 (bottom). The width of the active channel remains similar (as per Figure 5).

[24] Imagery for 2019/2020 sourced from the LINZ Data Service and licensed for reuse under the CC BY 4.0 licence. Imagery for 1950 created using imagery from http://retrolens.nz and licensed by LINZ CC-BY 3.0. Mosaic available at https://koordinates.com/data/?mv.basemap=Satellite&mv.content=layer.113562.opacity:100,layer.113571.opacity:100,layer.113574.opacity:100,layer.113573.opacity:100&mv.zoom=10&mv.centre=176.68187799565194,-39.743953489552894

Figure 7: Aerial imagery[25] of the Ngaruroro River about 5km downstream from the Whanawhana Cableway in 1950 (top) and 2019/2020 (bottom). The width of the active channel remains similar (as per Figure 5).

[25] Imagery for 2019/2020 sourced from the LINZ Data Service and licensed for reuse under the CC BY 4.0 licence. Imagery for 1950 created using imagery from http://retrolens.nz and licensed by LINZ CC-BY 3.0. Mosaic available at https://koordinates.com/data/?mv.basemap=Satellite&mv.content=layer.113562.opacity:100,layer.113571.opacity:100,layer.113574.opacity:100,layer.113573.opacity:100&mv.zoom=10&mv.centre=176.68187799565194,-39.743953489552894

47. I agree that the lower Ngaruroro River downstream of the start of the HBRC Flood Management Scheme has been constrained, and then altered significantly from the point at which the river is lined on both sides with stopbanks (see Figures 2-4). However, I consider the braided character of the river between the Whanawhana Cableway and the top of the HBRC Flood Management Scheme to still be highly natural with little human modification. I also consider the section between the top of the HBRC Flood Management Scheme and Fernhill Bridge / Omahu stands out for its braided character when considered against other Hawke's Bay rivers (discussed further below).

48. When assessed against HBRC's preferred criterion at List A (a) for Natural Character ("The water body is highly natural with little or no human modification, including to the flow, bed and riparian margins, water quality, flora and fauna, within a largely indigenous landscape"):

    a. There is a progression from highly natural flows at Whanawhana through to significantly modified low flows at Fernhill/Omahu and Chesterhope.[26] Flood flows supplied from the upper river to Whanawhana have remained steady over the past 50 years.[27] There are no dams in the upper catchment.

    b. The geomorphological character of the bed of the lower Ngaruroro River from the Whanawhana Cableway downstream to the top of the HBRC Flood Management Scheme is highly natural with little human modification. It becomes progressively more confined from this point and is then highly modified once confined on both sides by stopbanks (downstream of Fernhill/Omahu). This is based on my assessment in the paragraphs above.

    c. The water quality, and flora and fauna in this reach are highly natural with little human modification. This conclusion is based on:

        i. The conclusion in the 'Special Tribunal Recommendation Report on Application for Water Conservation Order' for the Ngaruroro River, which stated (at para. 246) "The Tribunal accepts that the water quality in the lower Ngaruroro is very good, especially

[26] "the Ngaruroro at Whanawhana has natural flows, the downstream records of Fernhill and Chesterhope are significantly modified at low flows due to irrigation abstractions." (Para. 50 of Statement of evidence of David William Stewart, dated 29 November 2018, for the Ngaruroro WCO Special Tribunal hearing on the application).

[27] "the annual flood frequency [at Kuripapango] is mainly steady over the 50-year period." ("This site was used in preference to the Whanwhana site because it has the longest usable record"). Para. 56 of the Statement of Evidence of David William Stewart, dated 18 October 2017, for the Special Tribunal hearing on the Ngaruroro WCO application.

in the context of a lowland river draining a rural catchment" and (at para. 239) "Dr Hicks, for HBRC, presented evidence that indicated a large number of sites supported "good or superior water quality to the lower Ngaruroro River""

ii. Holmes' (2019)[28] conclusion, as supported by Joint Witness Statement[29] for the Special Tribunal hearing on the Ngaruroro WCO application, that "the lower Ngaruroro River has the highest fish diversity that can be expected in a region of New Zealand with moderate overall native fish diversity."

iii. The recognition of the native bird habitat (and populations) in the Special Tribunal report and Environment Court decision on the Ngaruroro WCO application, and the recognition of this in the Council's preferred version on PC7.

d. The riparian margins through this reach show human modification as a result of exotic planting and agricultural land use. However, much of the river occupies the full extent of the floodplain (with braiding) and is lined by cliffs associated with terraces (as illustrated by aerial imagery in the Figures above).

e. The lower Ngaruroro River does not exist within a "largely indigenous landscape" (also illustrated by aerial imagery in the Figures above).

49. As per (e) above, regarding the criterion at List A (a) and Mr Rekker's comments in para. 9.71 of their evidence: I agree that the lower Ngaruroro River does not exist within a largely indigenous landscape, and therefore does not meet this part of the criteria. There has also been modification to the riparian margins. However, I note that none of the braided or semi-braided/wandering rivers in Hawke's Bay (the Ngaruroro, the Tukituki, the Waipawa, or the Tūtaekurī) flow through largely indigenous landscapes or have unmodified riparian margins. These criterion create an unreasonably high bar for a braided river to qualify as regionally outstanding.

50. In my opinion, this is a flaw with the screening criteria that should be addressed through amendment. In the context of the Natural Character criteria, an amendment that would allow the braided reaches of the Ngaruroro River to qualify as having regionally outstanding value would be to provide a partial exclusion to criterion (a). This could be achieved by amending the criterion to read:

[28] Holmes R. (2019) The relative value of the lower Ngaruroro River native fish community. Prepared for Hawke's Bay Regional Council. Cawthron Report No. 3089. 11p plus appendices.
[29] Expert conferencing joint report (Aquatic Science and River Ecology), 3 November 2017, para 10 (a). Special Tribunal hearing on the application for a WCO on the Ngaruroro River.

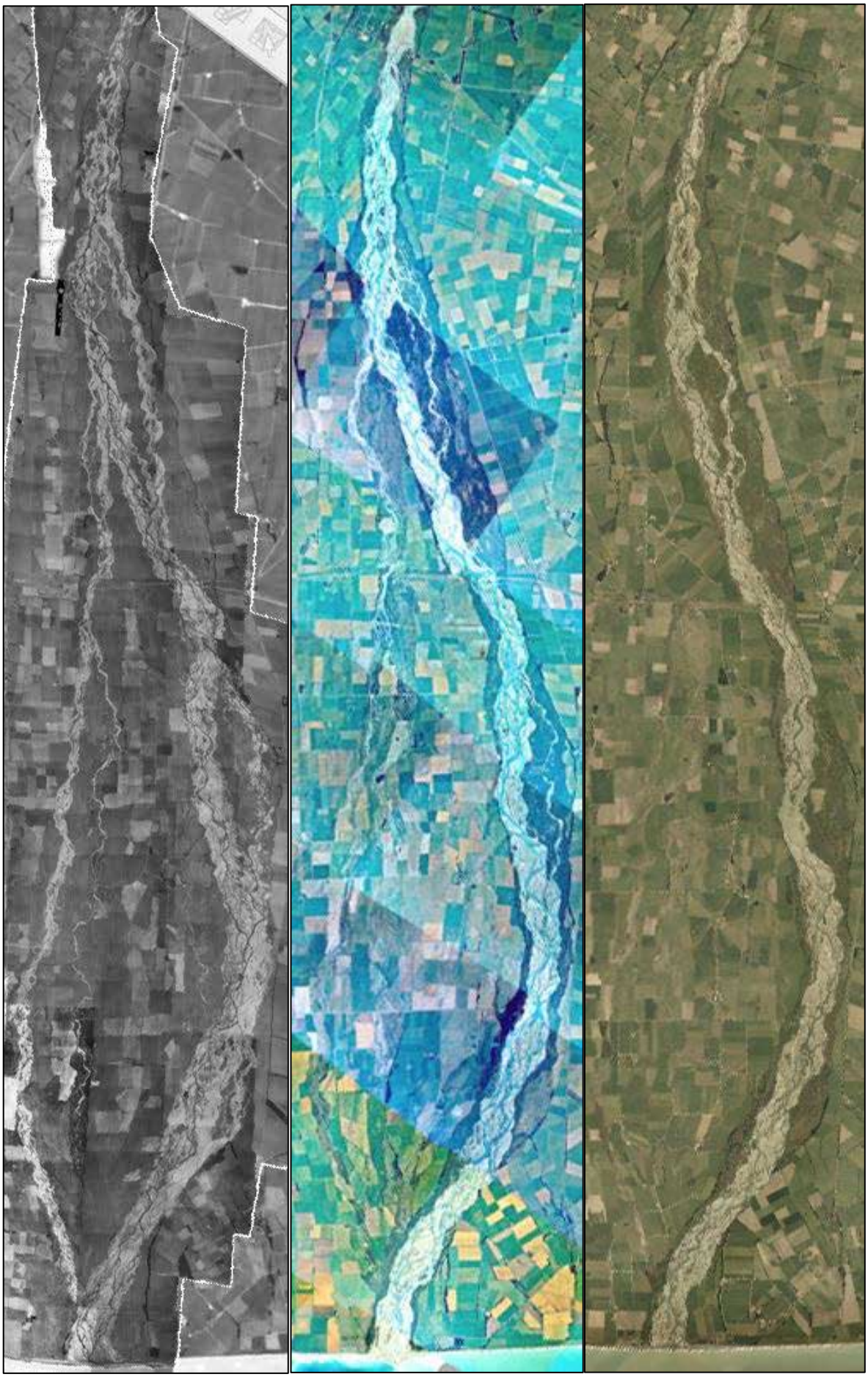
a) The water body is highly natural with little or no human modification, including to the flow, bed and riparian margins, water quality, flora and fauna, within a largely indigenous landscape~~.~~; except for braided (or other wandering) rivers, which can still hold outstanding natural character values where riparian margins and the surrounding landscape are modified, provided the other matters in (a) are met.

51. As noted above, the Rangitata and Rakaia River WCOs both apply to rivers that traverse a highly modified landscape (the Canterbury Plains) with varying degrees of modification to the "flow, bed and riparian margins, water quality, [and] flora and fauna" but were still afforded outstanding status for their braided characteristics. Figure 8 below/on the following page illustrates the degree of modification (from a historic reference condition in 1937) the lower Rangitata River had already been subjected to at the point of application for (1999), and then gazetting of (2006), its WCO.

52. I address Natural Character criterion (b) below in my assessment of "conspicuous, eminent and/or remarkable in the context of the Hawkes Bay region".

Figure 8 (following page): Lower Rangitata River in 1937 (left), 1995-1999 (middle), and 2004-2010 (right).[30] Note the significant encroachment into the active channel of the river and the reduction in its area from 1937 to 2004/2010, and the loss of channels – most significantly the entire south branch. Also note the highly modified landscape and riparian margins through which the river flows. The WCO application for the river was lodged in 1999 and the order was gazetted in 2006.[31] Despite the high degree of modification that had already occurred, the WCO includes "Scientific – braided river" as one of the "Outstanding Characteristics or Features" and lists this value throughout the river, including from the Rangitata Gorge to the coast.

[30] Imagery from Forest & Bird (1937) and Canterbury Maps (1995-1999 and 2004-2010) https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/
[31] https://environment.govt.nz/acts-and-regulations/water-conservation-orders/rangitata-river/



GEOLOGY CRITERIA: ASSESSMENT OF THE LOWER NGARURORO RIVER

53. HBRC's preferred version of Proposed Plan Change 7 includes four criteria for Geology that a water body must meet all of to qualify as outstanding for that value. These are:

    a. The geomorphological, geological or hydrological feature is dependent on the water body's condition and functioning.
    b. The geology values are conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region.
    c. The geomorphological, geological or hydrological feature is classified as Class A on the New Zealand Geopreservation Inventory.
    d. Evidence is provided in support of outstanding geology values by way of an expert assessment or independent evidence sources.

54. With regard to Geology criterion (a), paragraphs 18-22 of my evidence describe how the "geomorphological" features of a river are dependent on the water body's condition and functioning. In the case of the Ngaruroro River, the braided form of the lower river is dependent on the natural condition and functioning of the upper catchment. Natural flows and the natural movement of sediment from higher in the catchment are the geomorphological foundation of the braided reaches (e.g., it is undammed). In my opinion, the braided character of the lower river therefore passes criterion (a).

55. I address Geology criterion (b) below in my assessment of "conspicuous, eminent and/or remarkable in the context of the Hawkes Bay region".

56. With regard to Geology criterion (c), while the lower Ngaruroro River is listed in the New Zealand Geopreservation Inventory for its braided character and is described as "a 500 m wide gravel river bed with up to six separate channels with a distinctive braid pattern. This river has the best examples in the region", it is only listed as Class C.[32] Therefore, it does not pass this criterion.

57. Interestingly, the mapped area in the Inventory does not include the widest section of the channel (compare Figures 2-5 with Figure 9 below). It is unclear to me why this is the case.

[32] https://naturemaps.nz/maps/#/viewer/openlayers/484

Figure 9: Lower Ngaruroro River as mapped in the online New Zealand Geopreservation Inventory.

58. As noted earlier in my evidence, there are no braided (or semi-braided/wandering) rivers in Hawkes Bay classified as Class A on the New Zealand Geopreservation Inventory for their braided character. Therefore, no Hawke's Bay rivers can qualify as outstanding under the Geology criteria for their braided character.

59. Only one water body is listed in the preferred version of PC7 as having outstanding Geology values (and therefore presumably meeting this criterion) and that is the Mangahouanga Stream.

60. I note the Taruarau and upper Ngaruroro River gorges are listed in the NZ Geopreservation Inventory as Class C – both described as "One of the two best gorges in Hawkes Bay. Steep sided convoluted river meanders about 400 m deep through greywacke mountains." These are both included in the preferred version of PC7 for their Natural Character value (the Taruarau gorge is explicitly recognised in Schedule 25). The Expert Panel, in their report,[33] listed the braided character of the Lower Ngaruroro River, the Ngaruroro gorge, and the Taruarau gorge as 'Landscape' values based on their Class C listings in the NZ Geopreservation Inventory.

61. There appears to be very few braided rivers across Aotearoa classified as Class A on the NZ Geopreservation Inventory – the Rakaia River being the notable example (and having a WCO recognising this braided character). Braided character in the Waitaki and Wairau Rivers is allocated to

[33] Outstanding Water Bodies in Hawke's Bay. Report of the Expert Panel. April 2019. HBRC Report No. SP19-19. https://www.hbrc.govt.nz/assets/Document-Library/Outstanding-Water-Bodies/1.-Other-supporting-information/Local-Expert-Panel-Report.pdf

Class C,[34] like the Ngaruroro. The Rangitata River, despite having a WCO recognising its braided river value, does not feature in the Inventory.[35]

62. The effect of these criteria is that braided rivers in Hawke's Bay could not be considered outstanding by virtue of their braided character. In fact, rivers across Aotearoa would struggle to meet this criterion.

63. In my opinion, this is a flaw with the screening criteria that should be addressed through amendment. In the context of the Geology criteria, possible amendments that would allow the braided reaches of the Ngaruroro River to qualify as outstanding values would be

    a. Delete the criterion in List A (c) so a water body does not need to be listed in the NZ Geopreservation Inventory. This would remove conflict in making decisions about outstanding water bodies where there are inconsistencies in the Inventory (such as the Rangitata River not being listed despite having a WCO recognising its braided character; and the Ngaruroro being listed but only as Class C). Doing this would open the Geology criteria to be more subjective (though evidence must still be provided to support the potential outstanding value). I consider this to be the best option to address the issue.

    b. Provide an exclusion to the criterion in List A (c) for braided rivers. As above, this would remove issues with inconsistencies in the NZ Geopres. Inventory. However, it could create a possible inconsistency if used in other regions or with other types of rivers. For example, the Taieri River meanders in Otago are described in the Inventory as "Best example of a meandering river in New Zealand. Has a high degree of curvature and shows all stages of ox-bow formation." Despite this they are listed as Class B so would not pass the criterion for Geology (and would not qualify through a braided river exclusion).

    c. Change the criterion from requiring a listing as Class A to Class C in the NZ Geopres. Inventory. This would provide for the braided character of the lower Ngaruroro to be listed as having regionally outstanding Geology value because it is listed as Class C (Though there is still the curiosity of the widest section of the river not being mapped in the Inventory, and therefore potentially being excluded. Also note the Rangitata River in Canterbury still wouldn't pass the criteria as it is not listed in the Inventory).

[34] The Wairau is described as "Excellent representative example of braided river beds in Marlborough Rivers." https://naturemaps.nz/maps/#/viewer/openlayers/484
[35] Ibid.

64. I consider amendment (a) above to be the most appropriate to address the issue discussed in this section as it avoids issues with inconsistencies in the NZ Geopres. Inventory.

CONSPICUOUS, EMINENT AND/OR REMARKABLE IN THE CONTEXT OF THE HAWKES BAY REGION

65. Both the Natural Character and Geology criteria include a test that the "The [geology/natural character] values are conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region."

66. This mirrors the definition of outstanding, which "for the purposes of an outstanding water body: means conspicuous, eminent, and/or remarkable in the context of the Hawke's Bay Region."

67. In my opinion, the lower Ngaruroro River clearly stands out in the Hawke's Bay region for its braided character. In particular, the reach of the lower Ngaruroro River between the Whanawhana Cableway[36] and the Fernhill Bridge / Omahu.[37] In my opinion, the braided character of this reach meets the criteria of being "conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region." I consider this for several reasons.

68. Firstly, the Expert Panel noted the regional significance of the braided character of the lower Ngaruroro River, stating:

> The lower Ngaruroro is the second largest braided river in the North Island a historically rare ecosystem in New Zealand, and rare internationally.[38]
>
> Best example of a braided river channel in the region (regionally important) - Whanawhana to Fernhill bridge - NZ Geopres. Inventory

69. Secondly, based on a visual desktop assessment of the Ngaruroro, Tūtaekurī, Tukituki, and Waipawa Rivers (those generally considered braided, semi-braided, and/or wandering), the lower Ngaruroro River clearly stands out as having the widest sections of active channel and largest areas of exposed gravel, as well as some of the most significant sections of braiding. This character can be seen from a significant height in aerial imagery and literally stands out in the landscape, particularly the section just downstream of Whanawhana (Figure 10).

[36] Map reference NZTM2000: 1891901E, 5615830N.
[37] Map reference NZTM2000: 1923019E, 5611264N.
[38] I am not aware of what the Expert Panel (or their reference) considered the largest braided river in the North Island to be.

Figure 10: Aerial imagery[39] of Hawke's Bay covering the Tūtaekurī (top of image), Ngaruroro (upper-middle of image), Tukituki (right and bottom of image), and Waipawa (bottom left of image) Rivers. The active gravel (braided) area of the Ngaruroro River (seen as white/grey colour in the image) stands out against the landscape and is noticeably more obvious than the braided/semi-braided/wandering areas of the other rivers. Only at Fernhill Bridge/Omahu does the river become significantly less conspicuous.

70. Finally, the "conspicuous, eminent and/or remarkable" nature of the braided section of the Ngaruroro River is clear when the active channel width of the river is compared to that of other braided/semi-braided rivers in the region. Figure 11 shows the active channel width of the Ngaruroro River graphed against the Tukituki and Waipawa Rivers. It clearly illustrates how the Ngaruroro River is significantly

[39] Sourced from the LINZ Data Service and licensed for reuse under the CC BY 4.0

wider than these other rivers through significant sections of its length. A larger version of this graph is provided as an appendix to this evidence.

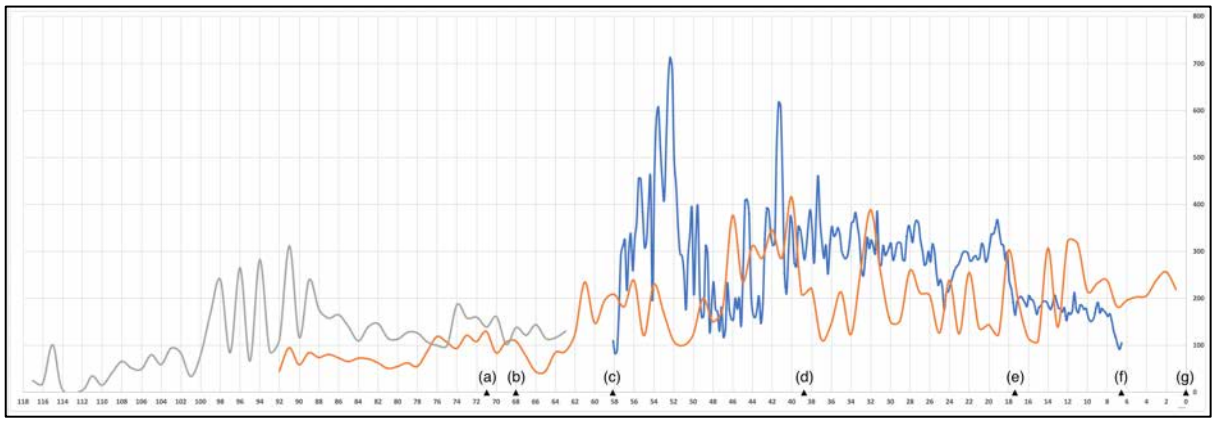


Figure 11: Graph comparing the active channel width of the Ngaruroro River (blue line) with that of the Tukituki (orange line) and Waipawa (grey line) Rivers. The y-axis shows the channel width in metres (scale from 0m - 800m where higher = wider) and the x-axis shows distance from the sea in 1 km increments (flowing from the left (upstream) to the right (downstream)). Black triangles show approximate locations (in terms of distance from sea) of (a) Waipukurau township, (b) Waipawa township, (c) Whanawhana Cableway, (d) top of the HBRC Flood Management Scheme, (e) Fernhill/Omahu, (f) Pakowhai/Chesterhope bridge, (g) sea. Note how the Ngaruroro River is around 700m through its widest reaches, whereas the Tukituki is around 400m and the Waipawa around 300m in their widest reaches. All measurements based on 2019/2020 imagery. Ngaruroro measurements taken at 200m intervals with a smoothed line connecting graphed measurements. Tukituki and Waipawa measurements taken at 1000m intervals with a smoothed line connecting graphed measurements. Larger version provided in appendix.

71. Mr Rekker states at para. 9.68 of his evidence that the Hawke's Bay region has "the Tukituki, Waipawa, and Tūtaekurī rivers with significant lengths of braidplains, in addition to the Ngaruroro" and at para. 9.70 states he is "of the opinion that the lower Ngaruroro River does not meet the threshold of conspicuous, eminent and/or remarkable natural character values in the Hawke's Bay context." Based on the above analysis, I disagree with the conclusion of Mr Rekker.

72. Based on the above, I consider the braided character of the lower Ngaruroro River upstream of Fernhill/Omhau is clearly outstanding in the context of the Hawke's Bay region. In my opinion, it meets the threshold of "conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region."

CONCLUSION

73. In my opinion, a possible outstanding value for a river is braided river character. This opinion is based on the (at least) two national Water Conservation Orders (WCO) which identify braided river characteristics as outstanding characteristics and features.[40] These cases indicate that braided river character is a value on which a river should be able to be considered outstanding.

74. I consider that the way in which the Natural Character and Geology screening criteria have been drafted in the Council's preferred version of PC7 effectively excludes braided river character being recognised as an outstanding value in Hawke's Bay.

75. With regard to the Natural Character value, a water body must be "within a largely indigenous landscape" (List A (a)) to qualify as outstanding. The braided reaches Hawke's Bay rivers are not located within largely indigenous landscapes – they traverse foothills and plains that have been modified (notably, cleared of indigenous vegetation). This effectively excludes these water bodies from being included for Natural Character. Water bodies must also have "little or no human modification" to their "riparian margins". This is a similarly difficult criteria to meet for a braided river, with many braided river channels either confined by old river terraces (which have been 'developed' on their tops) or adjacent to agricultural land uses (which utilise the plains for production – e.g., Hawke's Bay and Canterbury).

76. With regard to the Geology value, the criteria require that the "geomorphological, geological or hydrological feature" must be "classified as Class A on the New Zealand Geopreservation Inventory". There are no braided rivers in Hawkes Bay classified as Class A on the New Zealand Geopreservation Inventory. Therefore, no Hawke's Bay rivers can qualify as outstanding for their braided character. Many braided rivers across Aotearoa would not meet this criterion.

77. On the above basis, the lower Ngaruroro River does not meet the List A (a) Natural Character criteria, or the List A (c) Geology criterion.

78. In my opinion, the lower Ngaruroro River does meet the List A (b) criteria for both the Natural Character and Geology values, that the "values are conspicuous, eminent and/or remarkable in the context of the Hawke's Bay Region." I consider the braided character of the reach of the lower

[40] The National Water Conservation (Rakaia River) Order 1988 includes "an outstanding natural characteristic in the form of a braided river…"; and the Water Conservation (Rangitata River) Order 2006 includes "Scientific – braided river" as one of the "Outstanding Characteristics or Features". Note the Rangitata WCO specifically lists this value throughout the river, including from the Rangitata Gorge to the coast.

Ngaruroro River between the Whanawhana Cableway[41] and the Fernhill Bridge / Omahu[42], particularly the reach between the Whanawhana Cableway and the top of the HBRC Flood Management Scheme,[43] to meet this threshold.

79. I consider an amendment is needed to the Schedule 25 Screening Criteria to ensure braided river character can be recognised as an outstanding value in Hawke's Bay. I recommend (as discussed in the body of my evidence),

    a. providing an exclusion in the Natural Character criteria for braided rivers to be located within largely indigenous landscapes and have a degree of modification to their riparian margins,

    and

    b. deleting the requirement in the Geology criteria for a water body to be classified on Class A of the New Zealand Geopreservation Inventory.

[41] Map reference NZTM2000: 1891901E, 5615830N.
[42] Map reference NZTM2000: 1923019E, 5611264N.
[43] Map reference NZTM2000: 1906679E, 5610950N.

APPENDIX

LARGER VERSION OF FIGURE 4

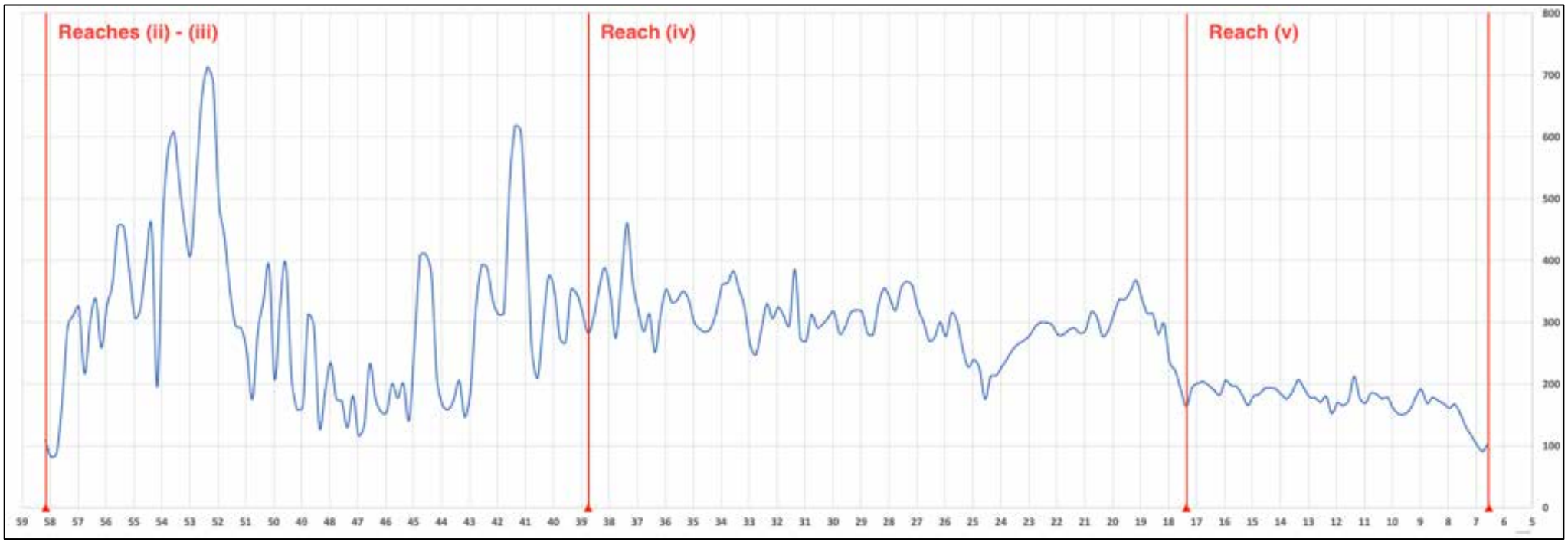


Figure 4: Graph showing the variation in the active channel width of the Ngaruroro River from the Whanawhana Cableway (left of the graph) downstream to within 6km the coast (right of the graph). The y-axis shows the channel width in metres (higher = wider) and the x-axis shows distance from the sea in metres (flowing from the left (upstream) to the right (downstream)). Substantial variation can be seen in the active channel width of the river upstream of the HBRC Flood Management Scheme area (Reaches (ii)-(iii)). The river narrows and becomes more consistent in width when it enters the HBRC Flood Management Scheme Area (Reach (iv)) and narrows again where it is lined on both sides with stopbanks (Reach (v)). Measurements taken in QGIS at 200m intervals using 2019/2020 aerial imagery. Smoothed line connects points.

LARGER VERSION OF FIGURE 11

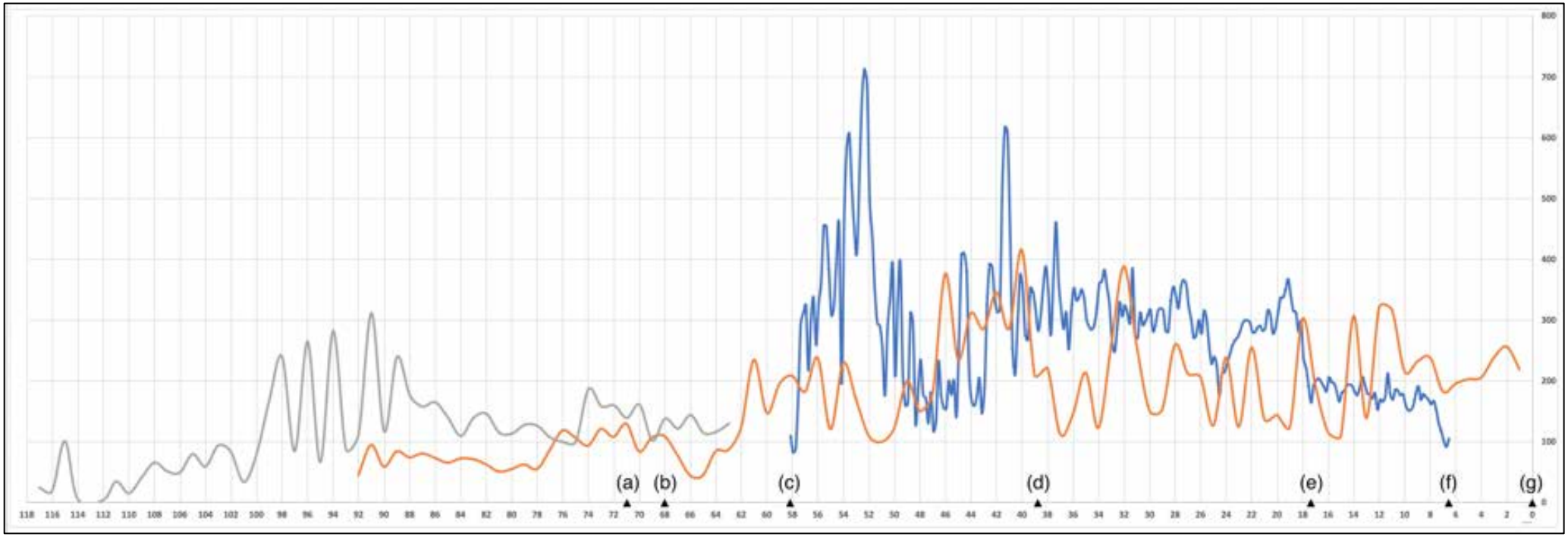


Figure 11: Graph comparing the active channel width of the Ngaruroro River (blue line) with that of the Tukituki (orange line) and Waipawa (grey line) Rivers. The y-axis shows the channel width in metres (scale from 0m - 800m where higher = wider) and the x-axis shows distance from the sea in 1 km increments (flowing from the left (upstream) to the right (downstream)). Black triangles show approximate locations (in terms of distance from sea) of (a) Waipukurau township, (b) Waipawa township, (c) Whanawhana Cableway, (d) top of the HBRC Flood Management Scheme, (e) Fernhill/Omahu, (f) Pakowhai/Chesterhope bridge, (g) sea. Note how the Ngaruroro River is around 700m through its widest reaches, whereas the Tukituki is around 400m and the Waipawa around 300m in their widest reaches. All measurements based on 2019/2020 imagery. Ngaruroro measurements taken at 200m intervals with a smoothed line connecting graphed measurements. Tukituki and Waipawa measurements taken at 1000m intervals with a smoothed line connecting graphed measurements.